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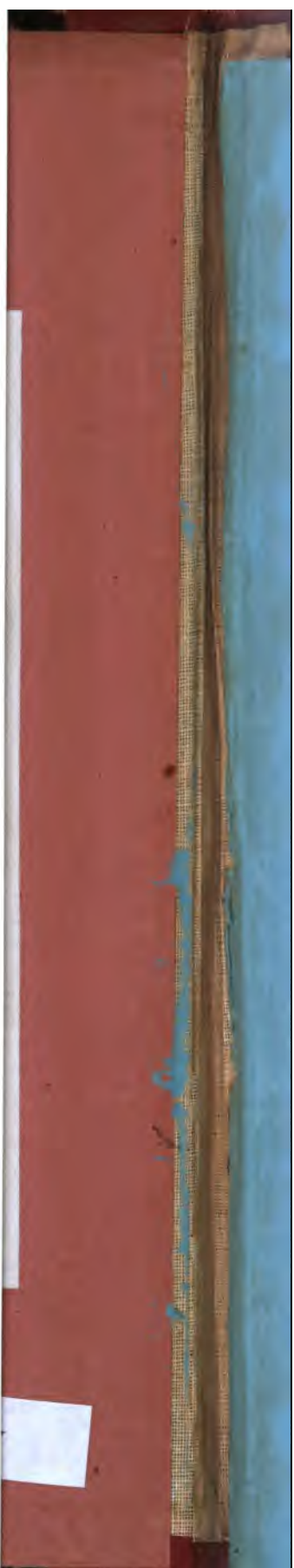
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A LECTURE

Cover

ON THE

IMPROVEMENT OF THE DANUBE AT VIENNA,

DELIVERED BEFORE THE

SOCIETY OF AUSTRIAN ENGINEERS AND ARCHITECTS

ON

MARCH 18, 1876,

BY

SIR GUSTAVE v. WEX,

*IMPERIAL ROYAL MINISTERIAL COUNSELLOR AND CHIEF DIRECTOR OF THE
IMPROVEMENT OF THE DANUBE.*

TRANSLATED BY

G. WEITZEL,

MAJOR OF ENGINEERS, BVT. MAJOR-GENERAL, U. S. A.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1880.

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Eng 10/8.80

1880 Nov. 19

By mail.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., September 17, 1880.

SIR: In connection with the treatise on the Decrease of Water in Springs, Creeks, &c., by Sir Gustav v. Wex, that eminent engineer has furnished this Department with a copy of his paper upon the "Improvement of the Danube at Vienna, read before the Society of Austrian Engineers and Architects March 18, 1876."

This paper has also been translated by General Weitzel, and I have the honor to recommend that it be printed at the Government Printing Office to accompany the first-mentioned pamphlet, which was printed under the authority of the Secretary of War of July 6, 1880.

Very respectfully, your obedient servant,

JOHN G. PARKE,
Acting Chief of Engineers.

Hon. ALEXANDER RAMSEY,
Secretary of War.

Approved.

By order of the Secretary of War:

H. T. CROSBY,
Chief Clerk.

SEPTEMBER 17, 1880.

VIENNA, *May 20, 1880.*

DEAR SIR: I am extremely honored by your esteemed letter of the 12th of February, 1880, informing me of the high importance you attach to the subject of my treatise upon the diminution of water in springs and rivers, and of the fact that the Engineer Department of the Army of the United States, to which is intrusted all river improvements on the Mississippi, has had this treatise translated into English for its own use.

In the event of this English translation having been printed or lithographed, I would beg you to send me, kindly, two copies of it for the use of my professional colleagues in London.

The favorable reception of this pamphlet encourages me to transmit you my treatise concerning the completion of the regulation works on

the Danube at Vienna and the experience connected with this important work, which, as I hope, will be of some interest to you.

I would beg you to kindly transmit the second copy of this treatise to the Engineering Department of the Army. I am convinced its members will be highly interested in comparing the results of the regulation on the Rhine from Strassburg to Mannheim (commenced sixty-two years ago) with the effects of the works on the Danube near Vienna.

To complete my first pamphlet I send you a copy of my paper upon the regulation works on the Danube, read on the 18th of March, 1876.

I have the honor to remain, sir, very respectfully, your obedient servant,

G. v. WEX.

Maj. Gen. A. A. HUMPHREYS,
Washington City, U. S.

NOTE BY THE TRANSLATOR.

I have translated everything except the values of $F_1 U_1 R_1 v$, $F_1 U_1$, $R_1 v_1$, $F_2 U_2 R_2 v_2$ in the calculations for discharge of the river at the zero and 12' 5½" stage, and the dimensions in Figure I.

There was an error—in print, undoubtedly—and I could not make them agree. Those values and dimensions, therefore, remain in Austrian measures. A foot Austrian measure is 12.448 English inches. I have in this case, as in a former translation of one of this author's works, adhered very closely to the text, in order that the reader may see how careful and precise the author is in expressing himself.

G. WEITZEL,

*Major of Engineers,
Brevet Major-General, U. S. Army.*

IMPROVEMENT OF THE DANUBE AT VIENNA.

[Extract from the Journal of the Society of Austrian Engineers and Architects, No. 5,
1876.]

HIGHLY ESTEEMED ASSOCIATES: Being convinced that you take a lively interest in the great work which has been executed on the improvement of the Danube at Vienna, I will take the liberty to give you detailed information concerning the effect of such works as have so far been constructed in removing the danger of overflow at Vienna, based upon the observations which were made, and the facts which were established during this year's ice-flow and flood.

Since the projects for the improvement of the Danube which have been carried out are sufficiently well known to most of you, my esteemed associates, partly through my lecture delivered before this society on March 11, 1871, and January 2, 1875, and partly by the plans, opinions, and views of experts, which were published in our journal, I do not consider it necessary to-day to enter upon their renewed description.

I will also only recapitulate the chief periods of the formation and final moving of the ice-gorges which were formed in the Danube during the past winter in so far as it may be necessary to sustain my arguments and conclusions, since Baron v. Engerth, court counsellor, has already communicated the details in his lecture of last Saturday.

Since the effect of every ice-flow and flood can only be clearly appreciated in connection with the extent and position of the former and the height of the latter, I have at first arranged in the following tabular exhibit all of the extraordinary ice-flows and floods which have occurred in the Danube at Vienna since 1826, and the highest gauge-readings taken during their existence at the three chief stations, *i. e.*, at the great Tabor bridge, Nussdorf, and the Ferdinand's bridge across the Danube Canal.

Tabular exhibit.

Years.	Date of high water.	Highest stages in the Upper Danube at—		Date of ice-flows and high water.	Corresponding highest stages at—			Notes on the ice-flows and high waters at Vienna.
		Linz.	Stein.		Tabor bridge.	Nussdorf.	Ferdinand's bridge.	
1829	June 10 June 12	<i>Ft. in.</i> 10 1½	<i>Ft. in.</i> 13 3¼	June 12	<i>Ft. in.</i> 9 2	<i>Ft. in.</i> 12 4½	<i>Ft. in.</i> 12 3½	High water in summer. The very high stages at these three gauges were caused by the removal of the ice-gorge to the Danube at Vienna and into the Vienna Danube Canal, there damming the water. Through this the greatest and most destructive inundation of the nineteenth century, in which many lives were lost, was produced.
1830	Mar. 1 Mar. 2	14 9½ 16 1		Mar. 1	19 8½	19 2½	22 10	
1840	July 31	15 6½		Aug. 2	9 3	12 1½	12 6½	High water in summer. The ice-gorge formed at the Tabor bridge. These rises were produced by masses of ice piling themselves upon each other in the Danube Canal as well as in the bed of the stream, and caused considerable overflows of the suburbs of Vienna.
1845	Apr. 1 Apr. 2	16 6 14 5		Apr. 3	9 2	12 3½	12 11½	
1847	Feb. 20	8 5½	7 5½	Feb. 20	9 3	9 8½	14 10½	High water in summer. These high stages at Vienna were caused by the moving of the ice-gorge into the Danube Canal and stream, in spite of the small discharge of the upper stream. After the complete and unhindered passing off of the ice-gorge, in consequence of a sudden, warm, and protracted rain, one of the highest stages was produced, which caused a great inundation.
1849	Jan. 16	8 1½		Jan. 17	8 3½	10 9½	18 1½	
1850	Jan. 17 Feb. 4	 13 1½	6 11 14 0	Jan. 17 Feb. 4	 14 5½	 12 8½	 14 6½	
1853	June 20 June 22	14 6½	13 0½	June 22	9 5	11 11	12 5½	The ice-gorge was formed at the Tabor bridge and in the canal, and caused a very destructive inundation of the suburbs of Vienna.
1861	Jan. 26 Jan. 28	0 2	4 10	Jan. 28	10 4½	14 0	12 2½	
1862	Feb. 3 Feb. 4	16 2	19 2½	Feb. 5	12 2½	16 5	15 9½	The gauge at the Emperor Francis Joseph's bridge read 14 feet, but was reduced to the zero of the gauge at the Tabor bridge, i. e., to 12 feet 11½ inches. The ice-gorge moved partly through the Danube Canal, but mostly through the cut-off, and first stopped above the Northwest Railway bridge, and subsequently above the Stadtlauer bridge.
1871	Feb. 11 Feb. 13	4 11½	2 10½	Feb. 13	9 0	17 4½	20 2½	
1876	Feb. 17 Feb. 18 Feb. 19 Feb. 20	0 9½ 7 10½ 13 11 14 9½	 4 7 13 1½ 14 9½	Feb. 18 Feb. 19 Feb. 19 Feb. 20	12 11½ 17 5½ 19 4 14 6½	14 6½ At the Reichstrassen bridge. At the Military Bath. At the Stadtlauer bridge.	14 11½ 10 8½	

The corresponding highest gauge readings at Linz and Stein are also incorporated, to enable one to judge whether the high stages at Vienna were caused by floods or by the damming up of the stream by the formation of ice-gorges either in the bed of the river or canal.

From this table the following interesting data are obtained, viz:

1. During the period of fifty-one years, between 1826 and 1876, only three summer floods have occurred; but there have been nine heavy ice-gorges, attended with floods, caused by the damming of the stream.

The latter are the most numerous, highest, and by far the most dangerous, because the height of water occasioned by them does not depend so much upon the discharge of the stream as it does upon the severity and length of the winter during which the ice-gorge was formed, upon the manner and extent of the scourings and fillings caused by the ice in the beds of the river and the canal, upon the condition of the weather which causes the moving of the gorge, and, finally, upon the very weighty circumstance whether the moving of the gorge begins first at the up-stream or down-stream side.

It will be seen from the tabular exhibit that even during low stages in the main stream the water was raised to a considerable height by these scourings and heavy fillings in the beds of the stream and of the canal, and which occasionally have caused the water surface of the Danube Canal to be from 3' 7½" to 10' 4½" above that of the main stream. This was the cause of the destructive overflows which often occurred at the suburbs Leopoldstadt, Brigittenau, Rossau, and Weissgaerber, since several portions of the Vienna Danube Canal banks, as well as many of the streets and grounds in these suburbs, were only situated from 9' 4" to 11' 5" above the local zero of the gauge.

2. It is universally known that the winter of 1875-'76 was very severe, very long, and very prolific of snow; that on December 9, 1875, already it was necessary to close the lock at Nussdorf by means of its floating caisson in consequence of a heavy ice-flow, and that, furthermore, in consequence of the position of the ice-gorge in the Danube in Hungary, it had gradually so increased that it reached up to the Reichstrassen bridge; but then again had been shoved back and compressed by the force of the stream.

In consequence of the renewed heavy ice-flows from the upper portions of the stream on January 10 and 29, 1876, which, with slight interruptions, continued until February 16, 1876, the gorge was again enlarged and in turn compressed, so that on the date last mentioned the Danube from below Pesth up to about 9½ miles above Tulla, that is, for a distance of about 235½ miles, was full of ice, which, in many places, reached the bottom. This gorge, which was formed in the Danube during ten weeks of a severe winter, may therefore be safely classed as one of the largest, strongest, and most dangerous of any one since the memorable year of 1830.

In consequence of the mild weather which came suddenly in the west of Europe on February 16, 1876, and which produced thaw, with rain, the water in the Danube rose considerably, and the gorge commenced moving above Tulla on the 17th and at Nussdorf on the morning of the 18th, at the time the stage was about 12 feet above zero, and was forced,

with the addition of some large masses of ice from the improved stretch of the Danube at Vienna and the Vienna Danube canal, by the high water down to Fischamend, Petronell, and Hainburg. Here the masses of ice were piled high upon each other, since in the lower portion of the stream, in Hungary, the thaw had not yet had its effect and the gorge remained firm.

The circumstances attending such a forcing of an ice-gorge by the thaw and high water from Tulla past Vienna and down to Hainburg, must certainly be considered as among the most favorable.

If we do not consider the high stages which occurred during the moving of the ice-gorge on account of the partial back water caused thereby, and only those which ensued after the gorge had passed away, we find that the following high stages occurred :

	Ft.	In.
At Linz and Stein on February 20, 1876	14	9½
At Nussdorf on February 20, 1876	11	8
At the Emperor Francis Joseph's bridge, at six o'clock in the evening of February 20, 1876, and before the crevasse in the levee	12	11½
At the Reichstrassen bridge on the evening of the same date.....	12	9½

By comparing these with those of former years it will be seen that the stage in the Danube during and after this gorge belongs to the highest since the year 1830, and that therefore this event may be considered as one of the most remarkable ones produced by the elements during a period of 46 years. This is also conclusively proven by the numerous and destructive overflows of the cities situated above and below Vienna, particularly Passau, Linz, Krems, Hainburg, Graub, Waizen, and more particularly Pesth-Ofen. The consequences resulting from a sudden thaw after such a winter, in which much snow had fallen, were not only felt in the Danube, but on the Rhine, Elbe, and Seine, where many cities, and Paris even, suffered from higher and more destructive floods than have occurred since the last century.

3. Since, in former years, even with less extensive ice-gorges and at much lower stages of water, the suburbs of Vienna were overflowed, and in the extraordinary gorge and simultaneous high-water stages of this year Vienna was exempt from inundation (the flooding of a few low streets and grounds in Erdberg not being considered an inundation), it must be concluded after a thorough study of the present condition of the stream, the phases which were observed, and the data which were collected during this year's ice-flow, that the city of Vienna was alone saved from a catastrophe similar to those which occurred here during the fatal years 1830, 1849, 1850, 1862, and 1871 by the improvements of the Danube which have been made.

In order to furnish more detailed proof of the statement just made, I will take the liberty of giving the following facts and observed data:

4. It is universally known that after a strong ice-flow the gorge is at first formed mostly in the unimproved stretches of the stream below Pressburg, and then increases in extent up stream to above Vienna, and

gradually fills up the bed of the stream as it did in the past winter. In former years, however, the gorge was occasionally formed in the bend of the stream at the old Tabor and Northern Railway bridge, between their numerous wooden piles, and then extended up stream.

Furthermore, it is the universal experience that the ice-gorges which are formed in an unimproved portion of the river, or one that is partly obstructed by bridge piles, can only be lifted and moved down stream by the increased force of much higher stages of water, as was the case at Vienna in 1830 and 1850. In the cut-off at Vienna, which is about $4\frac{1}{2}$ miles long, has the form of a gentle curve, has a cross-section about 311 yards wide, and is dredged to a uniform depth of about $10\frac{1}{2}$ feet, no ice-gorge was formed during the recent repeated ice-flows. When in the beginning of January the ice had massed itself in the cut-off from Fischamend to the ferry, and then to the Reichstrassen bridge, the strong current repeatedly pushed it out and forced it down to Mannswörth. When finally, in consequence of the very heavy ice-flow which occurred on January 29, 1876, the ice-gorge extended from Pressburg to about $9\frac{1}{2}$ miles above Tulla, the cut-off was, of course, filled up with masses of ice, but yet a strong current of water was still maintained through it, as was clearly apparent by the numerous open channels which were washed out.

When on February 16 and 17, in consequence of the sudden thaw and rain, the gorge commenced moving down from Tulla and from Nussdorf on the morning of February 18, only part of the ice-masses which were rapidly piled upon each other remained in the cut-off between the Point and the Northwestern Railway bridge until four o'clock on the afternoon of the 18th. During this time a small part of the descending ice-gorge passed under the floating caisson and through the canal, and the greater part passed on the left-hand side of the high-water cross-section. The latter portions flowed back into the cut-off just below the Northwestern Railway bridge, and moved out rapidly.

At four o'clock on the afternoon of the 18th the masses of ice which were piled up above the Northwestern Railway bridge finally moved where the water had been backed up to the height of about $14' 6\frac{1}{4}''$ on the gauge at Nussdorf, and then all the gorge that remained above passed through the cut-off at the $12' 5\frac{1}{2}''$ stage.

A part of the gorge remained just above the Stadlau Railway bridge where the cut-off empties into the main stream. This occurred at the spot where the new left-hand bank and the new levee on the left-hand bank had not been carried across the old bed of the stream. The high water which carried the gorge, and which was confined between dams from Kahlenbergerdörfel down, ran off unimpeded at three places into the old bed of the stream and the left-hand channel, and then left the gorge undisturbed.

This change in the location of the gorge caused back water in the cut-off, during the night of February 18 to 19, to the height of $19' 4''$ at the

Military Bath; of 19' 5½" at the Reichstrassen bridge; of 14' 6¼" at the Stadtlau bridge, and 12' 11½" at the Emperor Francis Joseph's bridge.

This gorge passed off already, however, in the direction of Fischamend, during the night of February 19 to 20. A second gorge formed in the lower part of the Weidenhaufen cut-off, which is about 1½ miles long, about 187 yards wide above the zero, but below that is dredged to a depth of 8' 3¾", and to a width of about 125 yards, and which, for the present, has been left to the effect of high stages of water for its widening, deepening, and completion. This gorge forced the one which came down from the Stadtlau bridge to take the route in the old bed of the stream, which had not yet been completely dammed, at Alberndorf and Kaiser Ebersdorf, in the direction of Fischamend. No injurious effect on the state of affairs at Vienna was caused thereby, but the incomplete dam at the head of the Weidenhaufen cut-off was washed away for a length of 247 feet.

The gorge in the Weidenhaufen cut-off moved on the morning of February 20, at the 13' 5½" stage. Based upon the foregoing presentation of facts which occurred during the formations, the positions, and the moving of this year's ice-gorge, and the coincident high waters, the following conclusions can be drawn, viz:

a. If the cut-off at Vienna had not been in existence in 1876, and this year's heavy ice-gorges, with accompanying high water, had been compelled to pass off by the crooked, irregular old bed of the stream, which is crossed by two wooden bridges and obstructed by numerous piles, it is very probable that a gorge would have been formed here, and the water backed up as high as in 1830. The result would have been an inundation, and possibly a crevasse in the weak levee alongside of the former bed of the "Emperor's" stream, and a consequent destructive overflow of the suburbs of Brigittenau and Leopoldstadt.

The damming of the water in the old stream above the Stadtlau bridge to the height of 19' 3¼" above zero, which actually occurred during this year's ice-gorge, would have caused the overflow of the whole Prater and a portion of Leopoldstadt, since the old levee only reached as far up as the Emperor's Mills, and at many places the reference of its top was only 16' 7¼". This was only prevented in the recent case by the banks of earth which were deposited along the new right bank of the stream by the Commission for the Improvement of the Danube from the point at Nussdorf to below the Stadtlau bridge. This bank of earth has an average width of from 245 to 410 yards, and its top is in reference 20' 9".

b. It will be seen from the tabular exhibit that in former years, whenever ice-gorges and high waters occurred, the stage of the Danube at Nussdorf was in every case about 3' 1½" higher than at the Tabor bridge; and, further, that in 1830, 1862, and 1871, the stage at Nussdorf reached the height of from 16' 5" to 19' 2½" above zero, whereby particularly

the inundations of the suburbs of Vienna by the Danube Canal were caused.

During this year's extraordinary ice-flow and high water, the highest stage at Nussdorf was only during a few hours $14' 6\frac{1}{4}''$ above zero, and it is particularly due to this considerable diminution in the stage of the river at this point that the high water entered the Danube Canal with a largely reduced pressure.

This diminution in the height of the stage was only caused by the work executed by the Commission for the Improvement of the Danube, which consisted in removing the old works on the left bank of the river opposite Nussdorf, by which the normal cross-section was increased in width from $174\frac{1}{2}$ to $311\frac{1}{10}$ yards, in moving back the Hubert levee by which the high-water cross-section was widened from $414\frac{8}{10}$ to $829\frac{6}{10}$ yards, and, finally, by excavating the whole overflowed banks an average depth of $5' 2''$, by which the high-water cross-section of discharge was increased about 10,753 square feet.

c. In former years the stage in the Vienna Danube Canal at the Ferdinand's bridge was at ordinary ice-flows and high waters invariably from $2' 1''$ to $4' 2''$ higher than in the Danube at the Tabor bridge, and even attained the height of from $15' 9\frac{7}{8}''$ to $22' 10''$ above zero in the years 1830, 1849, 1862, and 1871.

During the recent ice-flows and high waters the highest stage at the Ferdinand's bridge was, during a few hours only, $14' 11\frac{1}{2}''$ above zero, therefore from $10\frac{3}{8}''$ to $7' 10\frac{1}{2}''$ lower than in the four years just mentioned, and only $2'$ higher than that of the Danube at the Emperor Francis Joseph's bridge. This considerable reduction in the high-water stage is due, firstly, to the reduction made in the heights of the stages at Nussdorf as above mentioned, and, secondly, to the influence of the floating caisson placed at the head of the lock at Nussdorf.

Court Counsellor Baron von Engerth has already, on the 11th instant, delivered a detailed lecture on the functions of this floating caisson at the various stages of the formation of the ice-gorges and their final moving, and I take the liberty here to mention, for the sake of preserving the connection only, that during the moving of the great ice-gorge on February 18 portions of the masses of ice crowded themselves under the caisson, flowed rapidly away by the canal which had been kept thus free from ice; was stopped by the ice-masses which had already formed in the bed of the stream at Albern, at the foot of the canal; filled up the bed and formed a gorge in the canal which reached up to the Emperor Francis Joseph's bridge and raised the water in the canal to a height of $15' 5\frac{3}{4}''$ above zero. The back water of the canal broke through the newly constructed levee on the left bank, whose top was at reference $14'$ above and below that bridge, and then, together with the masses of ice which floated down, poured into the lower part of the Prater.

The water then flowed off along the slope of the valley plain across

the Freudenau to the lower end of the same, where it broke through the levee which was in course of construction, in several places, and then emptied itself into the old bed of the stream, which it was intended should be shut off at Albern.

Now, it is undeniably true that, after the completion of the mouth of the Vienna Danube Canal, wherever in future an ice-gorge in the Danube is formed reaching from Pressburg to above Mannswörth, and thus closes the mouth of the canal, and then in consequence of a strong influx of ice-masses under the floating caisson a piling up of ice-masses in the canal and dangerous backing up of its waters might occur, it is necessary that, using the observations made of this year's ice-flows and all the experience which has been gained, to make further thorough study and to discover and construct such other contrivances as will enable us as far as may be necessary to more completely shut off the flow of ice-masses into the Danube Canal under the floating caisson at its head.

This floating caisson also did great service in another respect, in that, after it had been sunk deeper, it caused a smaller quantity of water to flow into the canal during the flood of February 19 and 20, and caused a difference in height of the water surface of the Danube at Nussdorf, and that of the Danube Canal at the Ferdinand's bridge, of from 2' 0 $\frac{1}{4}$ " to 3' 0 $\frac{3}{4}$ ", and this certainly contributed a great deal to preventing the inundation of the lower suburbs of Vienna.

d. The commission for the improvement of the Danube in the period from 1872-'75 also caused the Vienna Danube Canal to be dredged throughout, at its center line to a depth of from 7' 3 $\frac{1}{2}$ " to 9' 4 $\frac{1}{4}$ ", and on both banks to a depth of 5' 2 $\frac{1}{2}$ " below zero; furthermore removed all the bars in the bed of the canal, which were deposited by the creeks emptying into it, and which sometimes extended across the whole bed, and then with this dredged material, which amounted to about 713,640 cubic yards, raised all the lower portions of the banks between Nussdorf and the Emperor Francis Joseph's bridge to a height of at least 12' 5 $\frac{3}{4}$ " above zero, and below the latter to the old mouth of the canal, at the so-called Prater corner, the banks were provided with levees with gentle slopes, whose heights vary from 12' 5 $\frac{3}{4}$ " to 15' 7".

By this improvement of the Vienna Danube Canal the circumstances attending its discharges, especially during high water, were considerably bettered, since now the formation of ice-masses in it and partial backing of its water cannot occur so easily as formerly. Besides this the very great benefit was secured that at a high-water stage of 12' 5 $\frac{3}{4}$ " even the low-lands and streets which lie behind the levees cannot be overflowed, whereas this formerly occurred in many places at from 10' 5" to 11' 5 $\frac{1}{4}$ " stages.

e. The commission for the improvement of the Danube, in 1873 and 1874, carried the Hurbert levee, on the left bank of the Danube, from Lang-Enzersdorf up stream; raised and strengthened it in a suitable-

manner, and finally joined it to the foot of the Bisam Hill, although this work was not included in the original approved project. This entirely prevents the discharge of the high waters of the Danube via Lang-Enzersdorf and Floridsdorf and the Marchfeld, a route which was again taken when the crevasse of 1862 in this levee occurred.

How important the reconstruction of this levee was is clearly to be seen from the events of 1874. Although it had been considerably strengthened by that time above its junction with the railroad dam leading to Stockerau, yet this part was in great danger of being broken through by the pressure of the high water, and a crevasse in it was only prevented by works of protection, which were carried on with the greatest energy by night and day.

After a thorough examination and appreciation of the facts and observations which have thus been enumerated, every experienced engineer will agree that the suburbs of Vienna were saved from a great and destructive inundation during this year's extraordinary ice-flow and high water by the construction of the works of the Danube improvement alone.

Now, if in addition all of the works for the improvement of the Danube which are begun are once completed, the levees all firmly closed, the enlargement of the Weidenhaufen cut-off is completed to the normal cross-section, the contrivance is added to the floating caisson at the head of the Danube Canal to thoroughly regulate the influx of ice-masses, and, finally, when the improvement of the Danube is completed according to the manner suggested in the original project from Mannswörth to below Fischamend, it will be clear to every one that the danger of an inundation of the city of Vienna and of the Marchfeld by the occurrence of extraordinary action of the elements will be still further removed.

The extraordinary ice-flow and coincident very high flood, as well as the loading test of the newly erected bridges, have furnished the truest and clearest proof that the project in accordance with which the improvement of the Danube has been strictly executed and which was made after a correct understanding of the conditions of the stream and in accordance with well-tried elementary technical principles is correct, not only as a whole, but also in all of its details, and that the improvement of the stream has already this year fulfilled its first requirement; *i. e.*, the removal of the danger of the inundation of Vienna, and that it will in the future undoubtedly fulfill it in a more brilliant manner.

Furthermore, the well-founded hope exists that the other requirements demanded of this improvement of the Danube, *i. e.*, the improvement of the sanitary condition of the low suburbs of Vienna by the drainage of their surface water, the facilitating and enlivening of the commerce and trade of Vienna, and finally the creation of the necessary room along the new stream for the enlargement of the city, and particularly for the erection of large commercial establishments, will be fulfilled in the same satisfactory manner.

In conclusion, I take the liberty to communicate to my esteemed associates that at the large and important works which have been constructed on the stretch of the Danube between Nussdorf and the Weidenhaufen cut-off, *i. e.*, the five permanent bridges across the Danube cut-off; the ten portions of quay wall whose total length is 1,165½ yards; the many landing staircases, whose total length is 493½ yards; the two large municipal bathing institutes and the large guard lock at Nussdorf (with the exception of a partial undermining of the concrete sole of the lock), not the least damage was caused by the ice-gorge and high water, and that the protected banks on both sides were not washed in anywhere, and that they were only slightly damaged at a few places.

This pleasing fact again furnishes the proof that the tracé of the improvement conforms to the conditions of the stream, since it does not give occasion either to the ice-gorges or the highly swollen stream to make direct attacks either against these works or the banks, and that these works have good foundations and are solidly built.

I consider that I ought to inform my esteemed associates in reference to the crevasse in the levee across the old bed of the stream above the Tabor bridge which occurred on the night of February 20 to 21, *i. e.*, after the ice-gorge had moved off, that it did not result from a direct attack of the stream but was caused by the circumstance that in consequence of repeated high water in the summer and fall of 1875 it was impossible to close the work on the left-hand side at Roller before the beginning of winter. The work was, however, prosecuted with the greatest energy by day and night, and this newly piled up and unsettled earth of the levee was very much softened and then broken through by the hydrostatic pressure of the 14' 6" stage applied only on one side.

The immediate closing of the crevasse was ordered so as to hold the high water for the purpose of carrying off the ice-gorge through the stretch, so dangerous to Vienna, at Nussdorf, and also to secure the two old wooden pile bridges (the Tabor and the Northern Railway) across the old bed of the stream against destruction by the ice.

The result of this precaution was entirely satisfactory, for the gorge which had formed above the Northwestern Railway bridge and had remained there until four o'clock in the afternoon of February 18, was lifted and carried off by the high water, which was firmly held between the levees on the two sides of the stream.

If this levee had not been completed, and the gorge had passed through the old bed of the stream, it is very probable that the two old wooden bridges above mentioned, which during the last few years have, in consequence of the intended closing of the old bed of the stream, been kept only in poor repair, would have been destroyed by the ice and high water. A greater loss would certainly have resulted from this than the expense occasioned by closing the crevasse in the levee.

5. The question has been raised by some whether the normal width for the cut-off adopted by the commission, and particularly the cross-

section of discharge, were sufficiently large to carry off, without damage, extraordinary high floods which occasionally occur, and I will therefore take the liberty here to discuss this very important question in detail. In the numerous projects which have been submitted for the improvement of the Danube since 1810, by various hydraulic engineers, only a single cross-section of discharge for medium and high stages was adopted, and the following normal widths for the improved bed of the stream suggested, viz:

	Yards.
By Schemerl, director of the imperial board of public works in 1810, for the cut-off	414. 56
For the total clear water-way of the proposed permanent bridge	601. 46
By the former imperial and royal counsellor of public works in 1817 for the width of the united Danube	372. 9
By Kudriaffski, director of hydraulic works in 1830, for the width of the united Danube, said to be based upon experiments and calculations.....	393. 68
By Francesconi, imperial and royal counsellor of public works in 1847, for the clear water-way of the united Reichsstrassen and Northern Railway bridge at Floridsdorf.....	452. 74
By von Pasetti, imperial and royal ministerial counsellor in 1859, for the united Danube above Nussdorf.....	414. 56
But from Lobau to Fischamand only.....	393. 68

From this statement it is seen that the above-named hydraulic engineers who had been engaged on works on the Danube, at Vienna, during periods of from 20 to 40 years, made very different suggestions as to the normal width to be given to the stream.

The experts who were called together in 1867, and who declared themselves in favor of the improvement of the Danube by means of excavating a cut-off, recognized the necessity, in order that a good stage of water should be maintained in the improved river, that there should be a special narrow bed for the discharge of low and medium stages, and a second enlarged so-called high water cross-section for the discharge of high stages. Upon this, these experts, having studied the older maps of the Danube and the state technicians, having communicated to them the circumstances attending the discharge of the Danube, proposed 345.57 yards for the normal width of the cut-off for low and medium stages, and 829.12 yards for that of the high-water cross-section. This proposition was adopted by the commission for the improvement of the Danube which existed at that time.

Based upon the thorough studies of the circumstances attending the discharge of the Danube which were continued by me, and the fact which was thereby established that the discharge of the stream at low and medium stages had decreased during several decades in a remarkable manner, I submitted a proposition on May 24, 1872, to the commission that the normal width of the cut-off between the edges of its two banks should be confined to 302.92 yards, but that the width of the high-water cross-section be retained at 829.12 yards, and at the same time furnished them with the calculations based upon hydraulic formu-

las on the motion of water in river-beds, showing that this modified cross-section would be quite adequate for the unimpeded discharge of the medium and high stages.

The commission called together seven distinguished hydraulic engineers, among them two foreigners to decide this highly important question, and then, after an almost unanimous opinion from them, restricted the normal width of the cut-off for low and medium stages to 310.57 yards and retained the width of the high-water cross-section at 829.12 yards.

In accordance with these widths the cut off, the high-water cross-section, and the levees on both banks were constructed as shown in cross-section in Figure I, from which it will be seen that the cross-section of the stream intended for low and medium stages is smaller, but that for high-water is very much larger than those proposed by the above-named five hydraulic engineers.

I believe that I should also now show that the cross-section of this improved portion of the stream, which has been carried out, is fully adequate to the unimpeded discharge of even the highest floods.

According to the measurements made by Kudriaffski, director of hydraulic works, the discharge of the Danube at Vienna should be per second:

	Cubic feet.
At the zero stage.....	70,269
At the 4' 10" stage	146,187
Where the banks are full, that is, at 12' 5½" stage	256,638

I could not ascertain from public documents the time in, the place where, or the manner in which these measurements were made.

The former imperial and royal ministry of commerce and public works charged Mr. Nicolaus, who was at that time inspector of hydraulic works, with measuring the discharge of the Danube in 1850 and 1851, at Nussdorf and about 2½ miles further up at the Kuchelau, in regular cross-sections four times daily, and with the greatest possible accuracy. He found that the discharge per second was as follows, viz:

	Cubic feet.
a. At the 1" stage above zero at the cross-section at Nussdorf.....	55,861
b. At the 2" stage above zero at the cross-section at the Kuchelau	56,426
c. At the 2' 8" stage above zero at Nussdorf.....	74,293
d. At the 2' 9" stage above zero at the Kuchelau	81,921

These results may be considered perfectly reliable, because the manner of measurement was entirely rational; furthermore, because Inspector Nicolaus is known to all the older officers in charge of public works to have been an experienced hydraulic engineer and as a man who executed all works intrusted to him with conscientious accuracy; and, finally, because the discharges measured at Nussdorf and the Kuchelau so nearly agree.

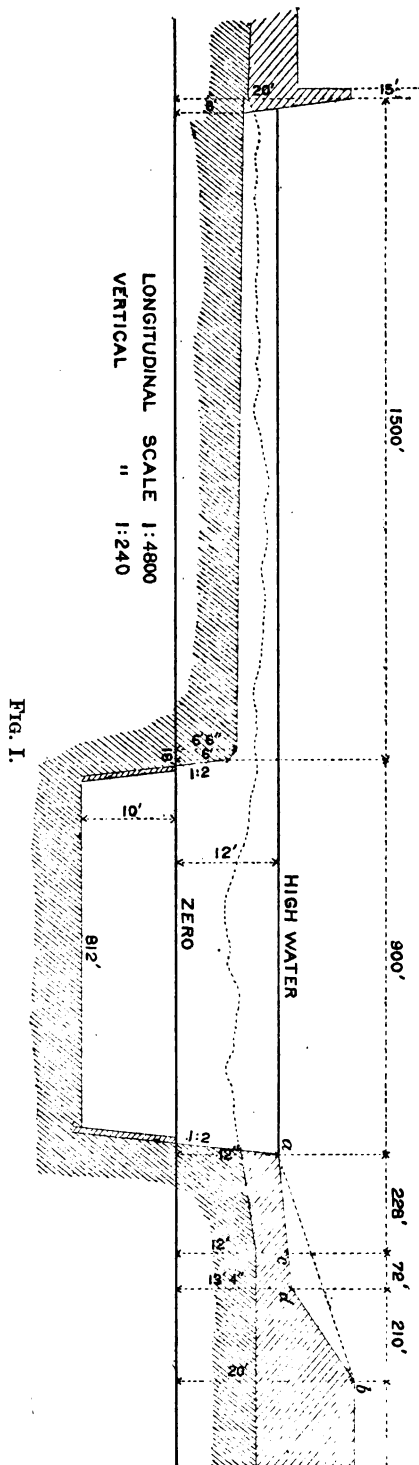
It appears from these measurements that the discharge of the united Danube above Nussdorf at the zero stage is about 55,000 cubic feet per

second, and that, therefore, this discharge given by Kudriaffski, *i. e.*, 70,000 cubic feet per second, is clearly about 20 per cent. too high. That the discharge given by Kudriaffski, when the banks are full, at the 12' 5 $\frac{1}{2}$ " stage, *i. e.*, 256,638 cubic feet per second, was not measured, but either estimated or approximately calculated, is apparent from the fact that since 1826 there has not been so high a stage at Vienna; furthermore, because there are no places in the vicinity of Vienna where there is a complete cross-section with banks 12' 5 $\frac{1}{2}$ " high; and, finally, because during such an extraordinary high stage the velocity of the stream is so great that it would be almost impossible to measure a cross-section and take the velocity at many points and at different depths thereof.

The Hungarian hydraulic engineers have, in former as well as in latter years, repeatedly measured the discharge of the Danube at different stages and with the greatest possible accuracy between Pesth and Ofen, where the concentrated river flows between high banks, and, on account of its smaller slope, has a smaller velocity.

The distinguished engineer Reiter, ministerial counsellor, had the kindness to send to the Society of Austrian Engineers and Architects the result of these measurements, as well as the gauge-readings, from 1857 to 1873, from which I will only select the following as being very interesting to us.

By comparing the gauge-readings at Vienna and Pesth during the period from 1855 to 1867 it will be seen that when the river has



reached the zero of the gauge at the Tabor bridge the corresponding stage observed two days later gives a reading of from 5' 5 $\frac{1}{2}$ " to 6' 4 $\frac{3}{4}$ " above zero at the gauge at Pesth, and that the mean of the gauge-readings at Pesth during a period of nine years, where the river had arrived at the zero at Vienna, was 5' 9".

Since the discharge of the Danube at Pesth at this stage was determined by measurement to be 59,604 cubic feet, and since the small tributaries of the Danube between Vienna and Pesth discharge into it at a low stage hardly more than 4,604 cubic feet per second, the measurements of discharge made at Pesth prove the measurements made above Nussdorf by Nicolaus, inspector of hydraulic works, to be more nearly correct.

According to the tabular exhibit given at the beginning of this paper, it appears that the highest stage of water which has occurred since 1826 at Vienna without an ice-gorge was on February 5, 1862, when the gauge-reading was 12' 2 $\frac{1}{4}$ " above zero; this passed off between Pesth and Ofen on February 7 and 8 with a constant gauge-reading at that point of 15' 8 $\frac{3}{4}$ ". Now, since according to the report of the ministerial counsellor, Reitter, which was furnished us, the measurements made between Pesth and Ofen show that at the 15' 8 $\frac{3}{4}$ " stage the discharge of the Danube is there 184,462 cubic feet per second, and when it is considered that between Vienna and Pesth the tributaries, March, Leitha, Raab, Waag, and Grau, must have discharged in the high stage during the period from February 5 to 8, 1862, more than 5,932 cubic feet per second, it follows that during the high stage of February 5, 1862, the discharge of the Danube at Vienna could not have been greater than about 178,530 cubic feet per second. Comparing this with the statement of Kudriaffski, director of the hydraulic works, who, it is true, assumed a stage 3 $\frac{1}{2}$ " higher, there will be found a difference of 79,108 cubic feet.

In order to prove that the cross-section, according to which the cut-off at Vienna was actually executed, and which is exactly represented in all of its dimensions in Figure I (p. 17), is fully adequate to discharge the quantities of water which, as has been shown, pass through, my associates will please make the following hydrotechnical calculation with me.

The latest and most reliable hydraulic equation to determine the velocity of water in rivers and streams is that of Gauquillet and Kutter, which has for Austrian measures the following form, viz :

$$v = \left\{ \frac{41 + \frac{1.779}{n} + \frac{0.00276}{J}}{1 + \left(41 + \frac{0.00276}{J} \right) \frac{n}{\sqrt{R}}} \right\} \sqrt{R J}$$

In this equation v denotes the mean velocity of the stream throughout the whole cross-section; J the slope of the stream; R the mean depth which is obtained by the dividing the arm of the cross-section F by the wetted perimeter U , and, finally, n , a coefficient obtained by ex-

perience, and which depends upon the friction of the material which forms the wetted perimeter.

The discharge per second, M , is obtained by multiplying the area of the cross-section F by the velocity of the stream v , *i. e.*, $M = F v$.

Since the average slope of the water in the cut-off at the zero stage is $J = 0.0004427$, and the coefficient of friction, according to the experiments made by Strauss, at Speyer on the Rhine, and by Destrem, on the Neva, can be taken at $n = 0.026$, we will obtain the discharge as follows:

I.—*At the zero stage.*

It will be found from figure I that the area of the cross-section $F = 8320$ square feet

$$U = 856.72' \quad R = \frac{F}{U} = 9.7114'$$

hence
and

$$v = 5.467'$$

$$M = 50777 \text{ cubic feet.}$$

Now, since about 3,354 cubic feet per second of the discharge above Nussdorf are carried off through the Vienna Danube Canal, and about 1,677 cubic feet per second are drawn off at Greifenstein for irrigating the Marchfeld, it will be seen that the cross-section of the cut-off which has been adapted is quite adequate for the discharge of the low and medium stages.

II.—*At the 12' 5½" stage.*

Although during the high stage, especially when it is rising, the slope of the stream is generally greater than at the zero stage, yet I will assume this slope as unchanged, and call

$$J = 0.0004427.$$

Furthermore, at high stages, the discharge of the stream through its normal bed must be calculated separately from that over its overflowed banks.

For the normal bed we will find—

$$F_1 = 18940 \text{ square feet} \quad U_1 = 909'$$

$$R_1 = \frac{F_1}{V_1} = 20.836'$$

therefore

$$v_1 = 8.754'$$

$$M_1 = F_1 v_1 = 184992 \text{ eubic feet.}$$

For the portion of the cross-section above the overflowed banks we find—

$$F_2 = 69.96 \text{ square feet} \quad U_2 = 1480'$$

$$R_2 = \frac{F_2}{U_2} = 4.727'$$

therefore
and

$$v_2 = 3.382'$$

$$M_2 = 26412 \text{ cubic feet.}$$

The capacity of the cross-section for discharge at the 12' 5½" stage, where the water just reaches the top of the right-hand bank, is therefore—

$$M_3 = M_1 + M_2 = 211,404 \text{ cubic feet.}$$

Consequently about 32,900 cubic feet more per second than the discharge of the Danube at Vienna during the highest flood on February 5, 1862.

Now, if it will be further taken into consideration that of the high water which passes Nussdorf about 15,600 cubic feet per second are discharged by the Vienna Danube Canal, and it is still further considered that, as shown by my lecture of March 11, 1871, after the improvement of the Danube to Fischamend, and the inevitable equalization of the slope which will ensue, the zero will be lowered in the cut-off at least from 1½" to 2", which is equivalent to raising its banks to that height, I believe that every experienced hydraulic engineer will agree with me that the normal widths and the cross-section of discharge which have been adopted are adequate for the unimpeded discharge of the highest floods, and that these will never rise over the 12' 5½" high-water bank.

As a protection against the backing up of the water which may now and then be caused by the ice-gorges, but which will not occur so often on the Danube where it is improved, and will not rise so high, the levees on each bank have been built to a height of 20' 9" above zero.

Now we will see what observations were made during the high water which came immediately after the gorge moved on the afternoon of February 20.

Although the gauge-readings at Linz and Stein were not as high on February 19 and 20, 1876, as those on February 3 and 4, 1862, yet, I believe that in consequence of the sudden melting of the large masses of snow between Linz and Vienna, which was caused by a warm and steady rain, that the high-water discharge at Vienna was as great on February 20, 1876, as it was during the highest stage of 1862. During this year's high water the following gauge-readings were taken at 6 p. m. on February 20; that is, before the crevasse in the levee at the Tabor bridge occurred, viz :

	Ft.	in.
Above Nussdorf, where the whole new cross-section of discharge was completed.	11	8
At the Emperor Francis Joseph's bridge, above the new zero.....	14	
And therefore above the old zero at the Tabor bridge	12	11½
And finally at the Reichstrassen bridge	12	9½

The reason that the gauge-readings were higher at the last two mentioned bridges than at Nussdorf is that in the cross-section of discharge at the former bridges the old spoil banks and the old Prague-Reichstrassen dam had not been completely removed, and the six houses which stood there had not been torn down, and, furthermore, because the scaffolding, laborers' barracks, restaurants, bath-houses, and an ele-

vated railway for the transportation of the material for completing the Reichstrassen bridge still remained, and, finally, because some masses of ice had been shoved onto the banks just below the Reichstrassen bridge, and still remained.

On this account the discharge of the stream was considerably impeded, and its surface raised.

It will be clear to every expert that if the high-water cross-section of discharge along the whole cut-off had been as completely open and unobstructed as at Nussdorf, the high-water mark of this year in the cut-off would not have gone beyond 11' 8" above zero, from which it will be seen again that after the works on the improvement of the Danube at Vienna are once completed that the cross-section of discharge will be adequate for the highest floods that will occur.

The high water of February 20 lasted, with slight variations, until February 24, and the high-water marks at the different places were as follows, viz :

At Linz, from 13' 8" to 14' 9 $\frac{1}{4}$ ".

At Stein, from 14' 6" to 15' 6 $\frac{3}{4}$ ".

At Greifenstein, from 11' 11" to 12' 5 $\frac{1}{4}$ ".

At the Kuchelau, from 14' to 14' 8 $\frac{1}{4}$ ".

At Nussdorf, from 11' 5" to 11' 10".

*At the Emperor Francis Joseph's bridge, from 9' 7" to 10' 1 $\frac{1}{4}$ ".

*At the Ferdinand's bridge, in the Danube Canal, from 10' 3 $\frac{1}{2}$ " to 11' 1 $\frac{3}{4}$ ".

From this it will be seen that the high water of this year lasted a long while.

I now hope that my esteemed associates, after a thorough examination and consideration of the facts and data which have been given by me concerning this year's in-flow and high water and the hydraulic calculations which I have added, will agree with me in the conclusion that the city of Vienna was alone saved from disasters similar to those which occurred so often in former years by the works on the Danube improvement, and that after these are thoroughly completed the protection of the city of Vienna against the danger from overflow will still be far more complete.

Finally. I beg you, my esteemed associates, to allow me to refer to the unfavorable opinions which have been published in several newspapers, partly upon the project for the improvement of the Danube and partly upon the effect of the works which have thus far been completed.

Since I and my professional colleagues have not time to reply to all attacks in the separate journals, we will leave them unanswered, in the hope that a true appreciation of the favorable effect of the works which have thus far been executed will in the end compel recognition.

*At these two bridges the water was considerably lowered by the crevasse.

The results of these one-sided statements and unwarranted attacks on the Danube improvement have, however, not remained absent.

At first I received letters from my friends in the provinces, in which they try to console me for the total failure of the works, as represented in Vienna journals.

The Times, in its issue of February 25, 1876, contains a communication from its correspondent in Vienna concerning the executed portion of the Danube improvement, in which he says that this great work has not fulfilled the hopes of its projectors, and that, on the contrary, it must be considered a total failure, since during this year's ice-flow the inundation of the suburbs Rossau, Leopoldstadt, Erdberg, and the country in the direction of Simmering was just as great as in former years, and that even the new central cemetery was so flooded that the corpses floated out of their graves, and that it was necessary to suspend interments in it during a long period.

Esteemed associates! You see how by such untrustworthy reporters, whose judgment of the project for the Danube improvement is based upon incorrect information and want of knowledge, this successful undertaking, which was much praised during its erection not only by the international jury, but also by more than twenty distinguished foreign engineers, and upon which Austria and Vienna may look with pride and satisfaction, is placed in bad credit and lowered in the estimation of foreigners.

I desire to refer particularly to an anonymous pretended expert who has already, in four articles published in the New Free Press, and entitled "The inundation and its causes," and based upon incorrect data and imaginary hypotheses, designated the whole project for the Danube improvement as a failure, and states even that the works which have been executed were the cause of the pretended inundation of Vienna.

Such a one-sided abuse, for I can no longer call it criticism, of the whole undertaking is so much the more to be regretted since the New Free Press is one of the most respectable papers in Austria, and is the most widely distributed in foreign countries.

In the short time allowed me I cannot recount and correct the many erroneous statements, defects, and charges made by the anonymous expert against the Danube improvement, but I hope you will permit me to point out some of the most glaring defects, since I am convinced that this alone will easily enable you to form an opinion of the knowledge of hydraulics possessed by this expert, and of his one-sided censure of the project for the Danube improvement.

1. The anonymous expert believes that the Danube cut-off was simply traced in plan as a curve to please the eye, without regard to the natural conditions which govern the bends of streams, and that thereby the resistance of the forces of nature was developed. He cannot justify the moving of the river nearer to the city, and intimates that it would

have been more advantageous to have allowed the Danube to remain in its old bed at Floridsdorf.

Gentlemen! In my lecture of March 11, 1871, I communicated to you that after a dispute lasting through a period of fifty years, and in which twenty-eight of the most distinguished native and foreign hydraulic engineers took part, it was finally concluded in 1867, to the great joy of Vienna and Lower Austria, to improve the Danube by a cut-off. This conclusion was approved on all sides.

Now, after this cut-off has been made at great expense, repays itself bountifully, and has proven itself, during the recent events caused by the elements, as very advantageous, this anonymous expert, plainly without any knowledge of antecedent proceedings and works of experts, utters this oracle, that there was no need of a cut-off, and that it would have been better, therefore, to have left the stream in its bend at Floridsdorf.

You will find it, esteemed gentlemen, quite natural that I do not now enter upon a discussion of such an oracle.

2. The anonymous expert states that the old bed of the Danube had a depth of 20' 9" below zero, and since the cut-off was dredged only to 10' 4½" below zero, the water must raise itself up in order to get into the cut-off, and then besides that in the shallow cut-off the formation of ice and ice-gorges was more extensive, and that consequently the water of the stream was forced through the Danube Canal. Based upon these premises he makes the following assertion, viz: "The new cut-off forms throughout its whole length an artificially constructed dam of earth in the old channel." He further says that the cut-off in its present condition is not only of no assistance in removing the danger of overflow, but is even an absolute obstacle against the free flow of the ice and water.

I must at first remark, by way of correction, that the premises of this expert are entirely incorrect, since the depth of water in the Danube in its old bed was only 20' 9" in the concavity of its bends, but in the stretches between these, and even in the channel, the depths did not exceed from 6' 2¾" to 7' 3", and the arithmetical mean of the depths taken on seven different cross-sections was found not to exceed from 9' 4" to 10' 4½" below zero; furthermore, I have shown in this lecture that the ice-gorge never came to a stand in the cut-off, but that in every case it formed from Pressburg upward, and naturally, therefore, the cut-off was filled with masses of ice.

It is also well known to you, my esteemed associates, that it is customary in making a cut-off to excavate a trench of from 62½' to 124½' in width and about 3½' in depth, and to leave its further deepening and widening to the power of high waters.

The commission, on the contrary, in order not to expose the city of Vienna to the danger of an overflow during the progress of the work, at great expense, and by the use of a suitable plant, caused the cut-off

to be dredged throughout its whole length of about $4\frac{1}{8}$ miles, to its whole width of $311\frac{1}{2}$ yards, and to the depth in its upper half of from $10' 4\frac{1}{2}"$ to $11' 5"$, and in its lower half of from $8' 3\frac{1}{2}"$ to $10' 4\frac{1}{2}"$ below zero.

I must, before proceeding further, admit that I do not know of any case in which such a colossal cut-off was dredged throughout its whole length, breadth, and depth, and yet this complete construction of the cut-off seems still too small to this anonymous expert, and he censures those in charge of the work with sharp, insulting words for having thereby exposed Vienna to the danger of an inundation.

My esteemed associates will agree with me that these assertions of the pretended expert, and particularly his utterance, printed with large type, that the new cut-off throughout its whole length is an artificially constructed bank of earth in the old bed of the stream, are technically and logically very incorrect, and are only calculated to lower the work in the eyes of laymen, and to awaken in the latter a totally ungrounded fear of danger from overflow.

3. This anonymous expert has also uttered the following oracle, *i. e.*: If the floating caisson had realized the expectations of its inventor, the inundation would have reached an unprecedented height, the water and ice, whose natural flow was obstructed, would have taken the next best route through Nussdorf, and the Danube might possibly have again taken possession of its old bed along the Salzgies, which it left hundreds of years ago.

If that portion of the masses of ice which came down from Klosterneuburg, which passed into the canal under the floating caisson, had been shut out by the latter it would also have passed off over the overflowed banks, which are $518\frac{1}{2}$ yards wide, and its flow would only have been delayed several hours.

Furthermore, if after the ice-gorge which formed below the Point had been raised and moved through the cut-off at 4 o'clock on the afternoon of February 18, by the damming up of the water to the height of $14' 6\frac{1}{4}"$ above zero, it is probable that if no masses of ice, and but little water, had passed into the canal under the floating caisson, this backing up to the height of $14' 6\frac{1}{4}"$ above Nussdorf would have occurred several hours sooner, and would have carried its whole ice-gorge through the cut-off.

But even in case the floating caisson had completely closed the head of the canal, and, in consequence thereof, the water at Nussdorf would have been backed up $1' 0\frac{1}{2}"$ or $1' 6\frac{1}{2}"$ higher, that is, to a height of $15' 6\frac{3}{4}"$ or $16' 0\frac{3}{4}"$ above zero, no danger would have thereby resulted to the Nussdorf dam on the right bank, for this mighty dam resisted the water successfully in the years 1862 and 1871 where it reached the height of $16' 5"$ and $17' 4\frac{1}{2}"$.

From the preceding it will be seen that the anonymous expert surely does not himself believe in his oracle, and that he only wrote it to create a sensation and to array non-professionals against the improvement.

4. This expert further insists upon it, that in preparing the project the discharge of the stream had not been ascertained, and that even to-day, when the most of the work may be considered completed, the discharge through the constructed cross-section is not known.

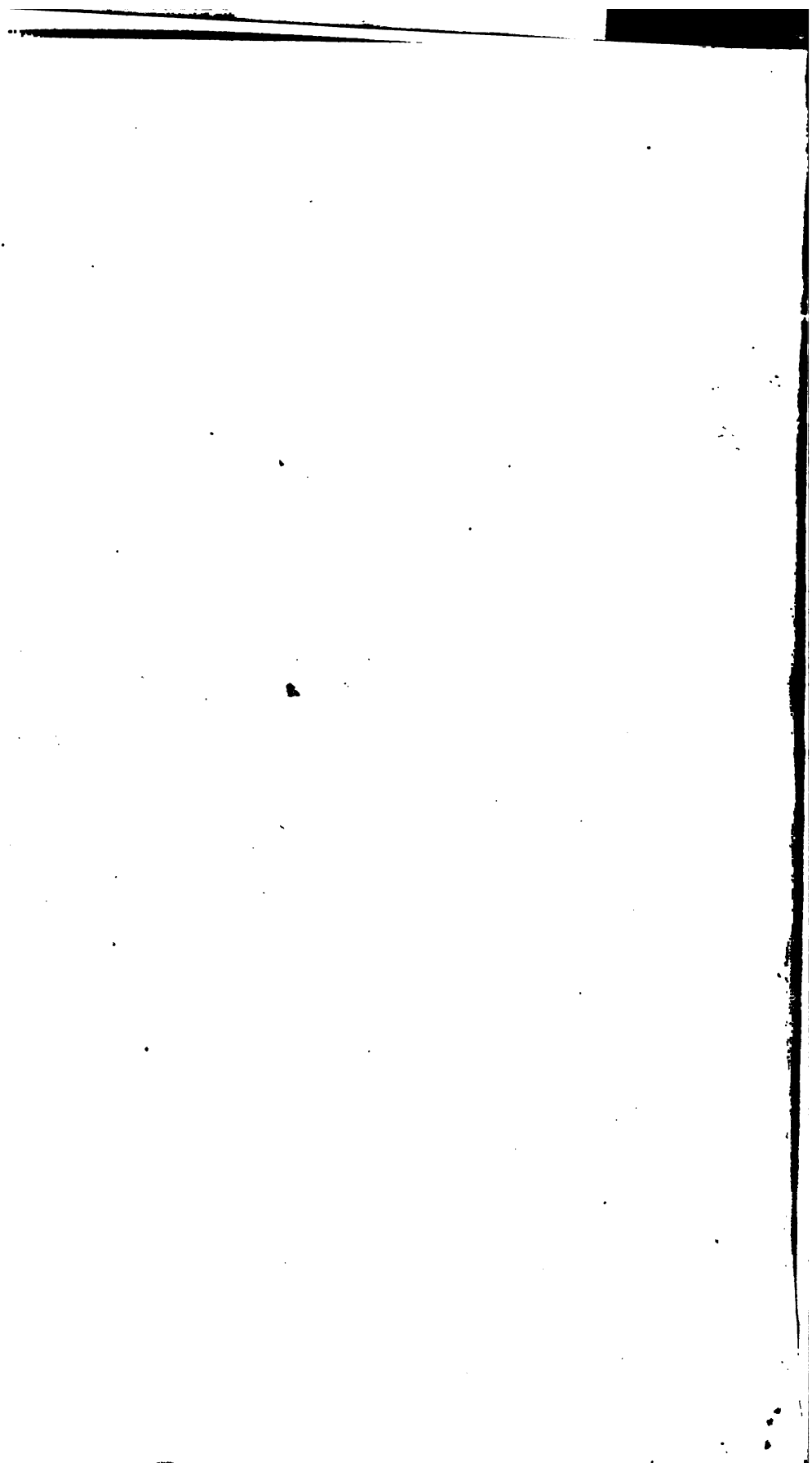
That this assertion is a clear falsehood is undoubtedly apparent to you, esteemed gentlemen, from that which I have already said.

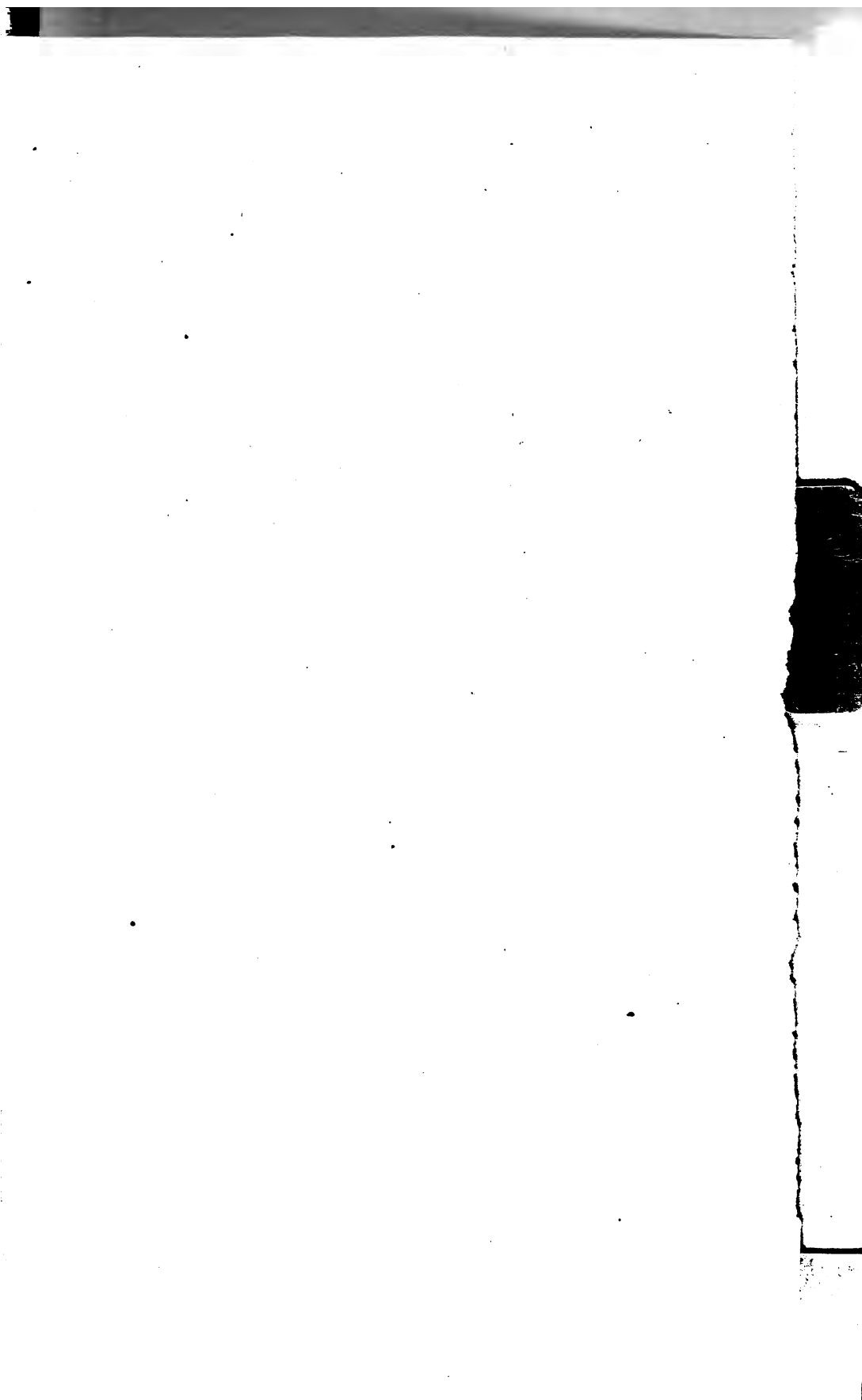
I do not believe that I ought to touch further on the numerous other slips and defects of the anonymous expert, since you, my esteemed associates, have already gained the conviction from the points which I have mentioned that he, either through ignorance, or based upon intentionally incorrect data, made technically entirely incorrect clearly one-sided assertions and conclusions only with the intention of disparaging the work which has been done, as well as the engineer intrusted with its charge, in the eyes of our fellow-citizens, without thinking, however, that by so doing he has brought this national enterprise in discredit in foreign countries, and has thus injured the interests of Vienna. This leads me to the conjecture that he is no Austrian, and at least not a patriot.

If the esteemed Society of Austrian Engineers and Architects should select a committee to gain a thorough understanding of the working of so much of the work as has been executed, I will take the liberty to make a motion that this committee be requested to thoroughly examine the assertions and complaints of this anonymous expert in the four newspaper articles to which I have referred, and to give an opinion thereon.

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